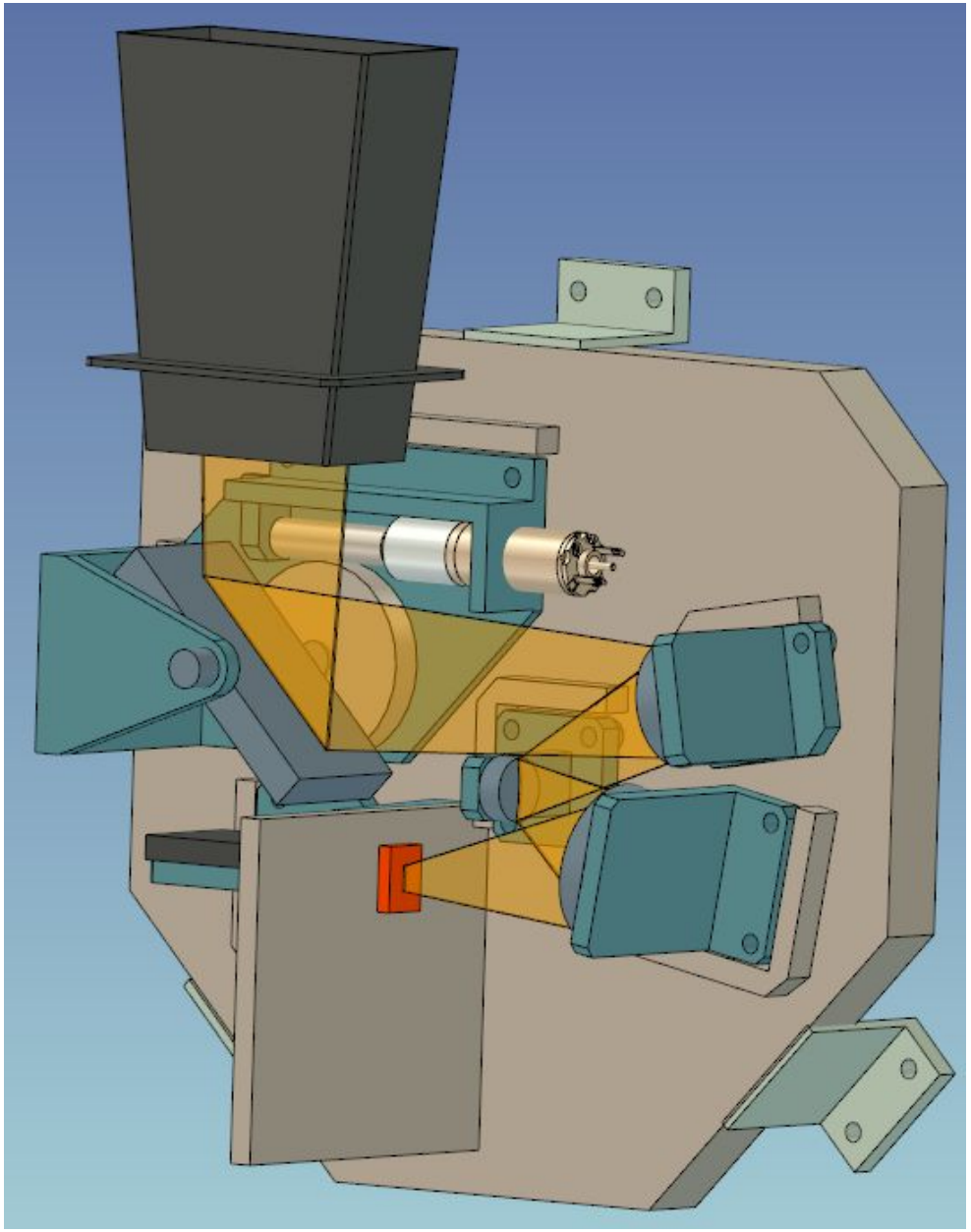
LIME JUICE

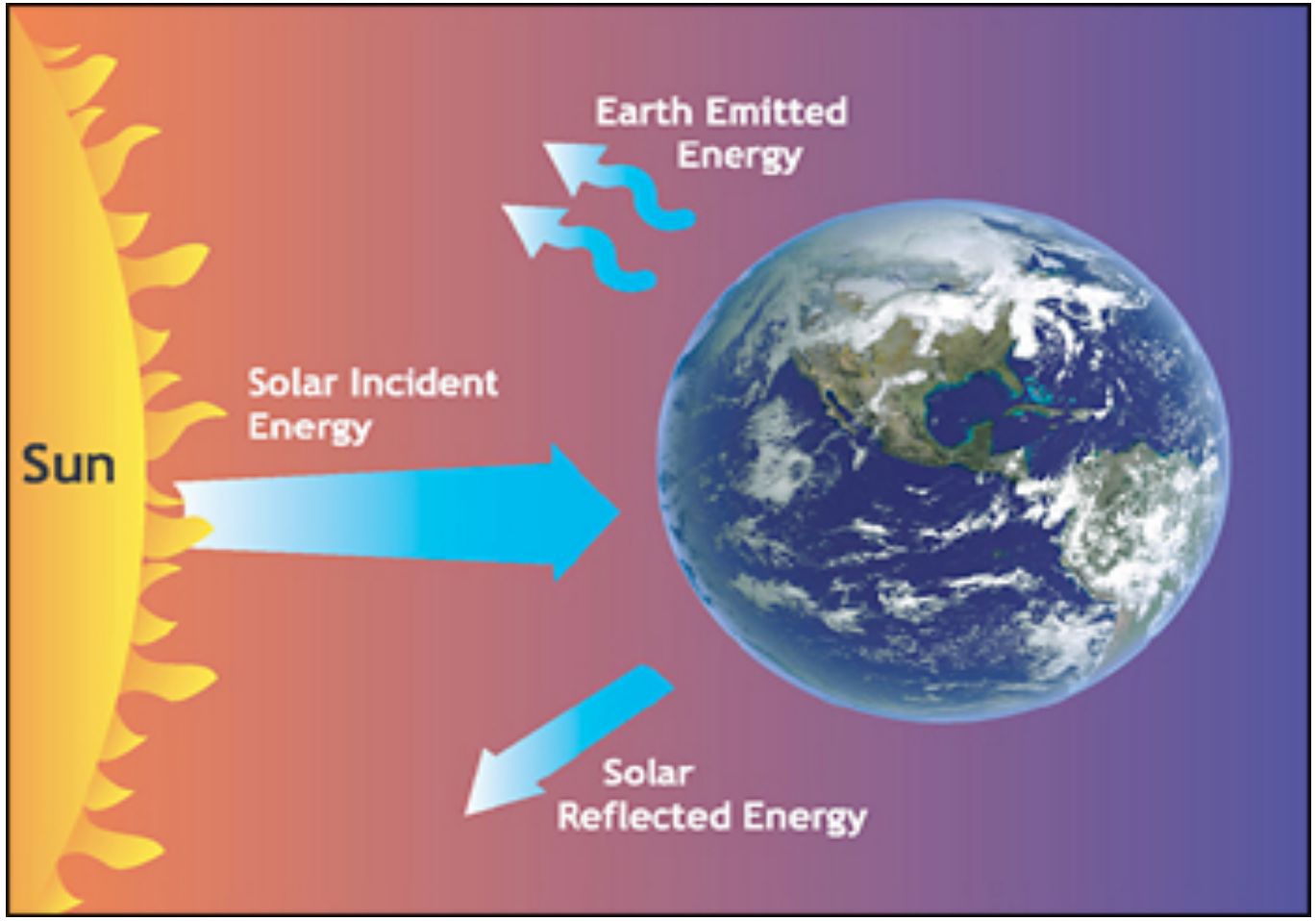
- Low Irradiance Monitor of Energy
- JUpiter and its ICy moons Explorer
- Proposal submitted 15 Oct 2012
- Strong heritage of GERB and Earthcare BBR
- Open for collaboration



Climate monitoring with Earth Radiation Budget measurements

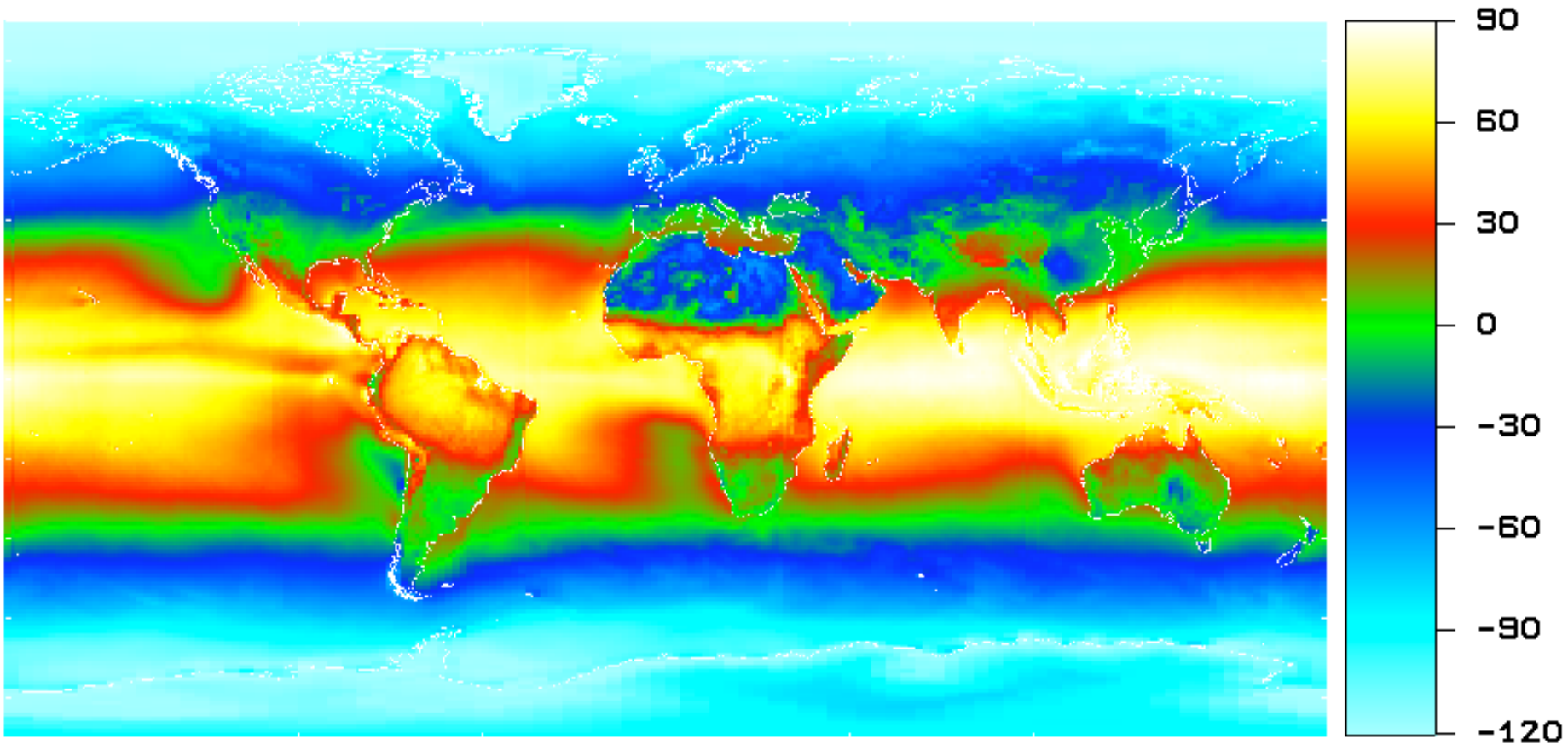
Steven Dewitte
RMIB

The earth radiation budget

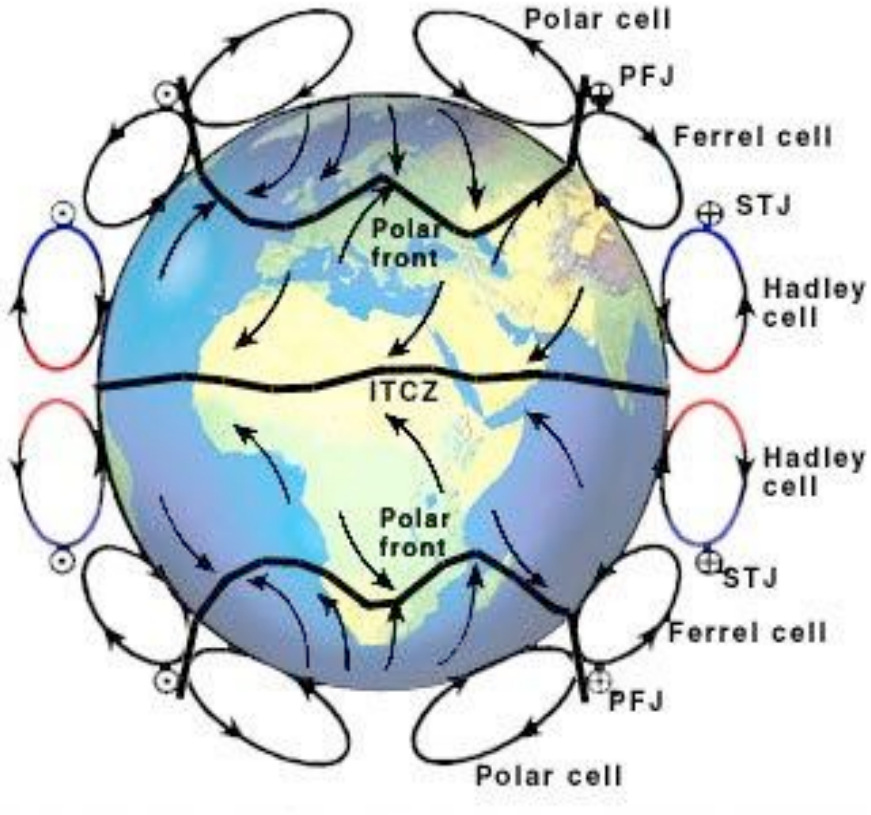


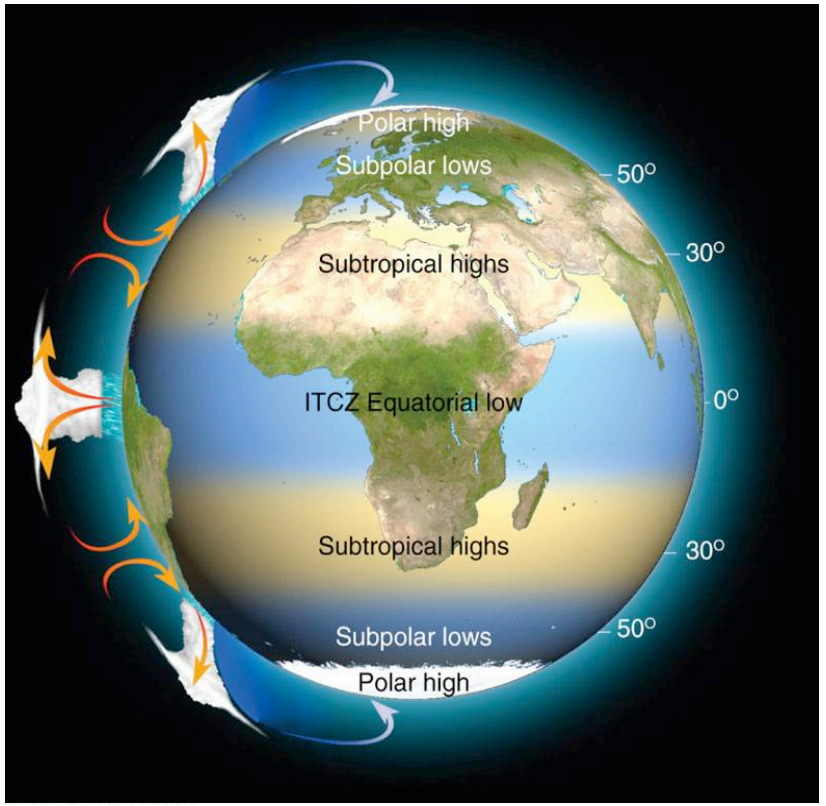
10 year annual mean Ceres EBAF net incoming radiation

W/m^2

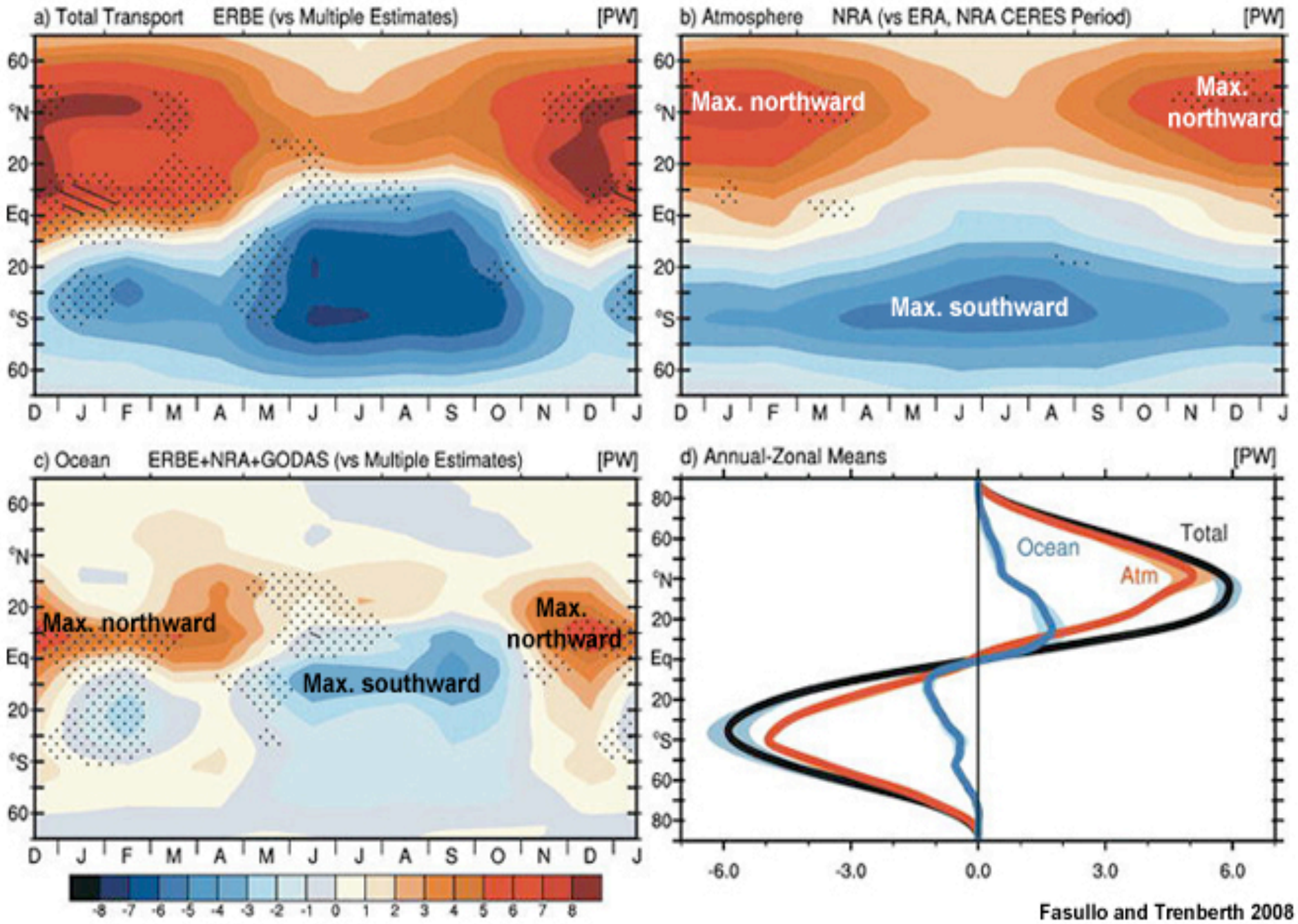


General circulation



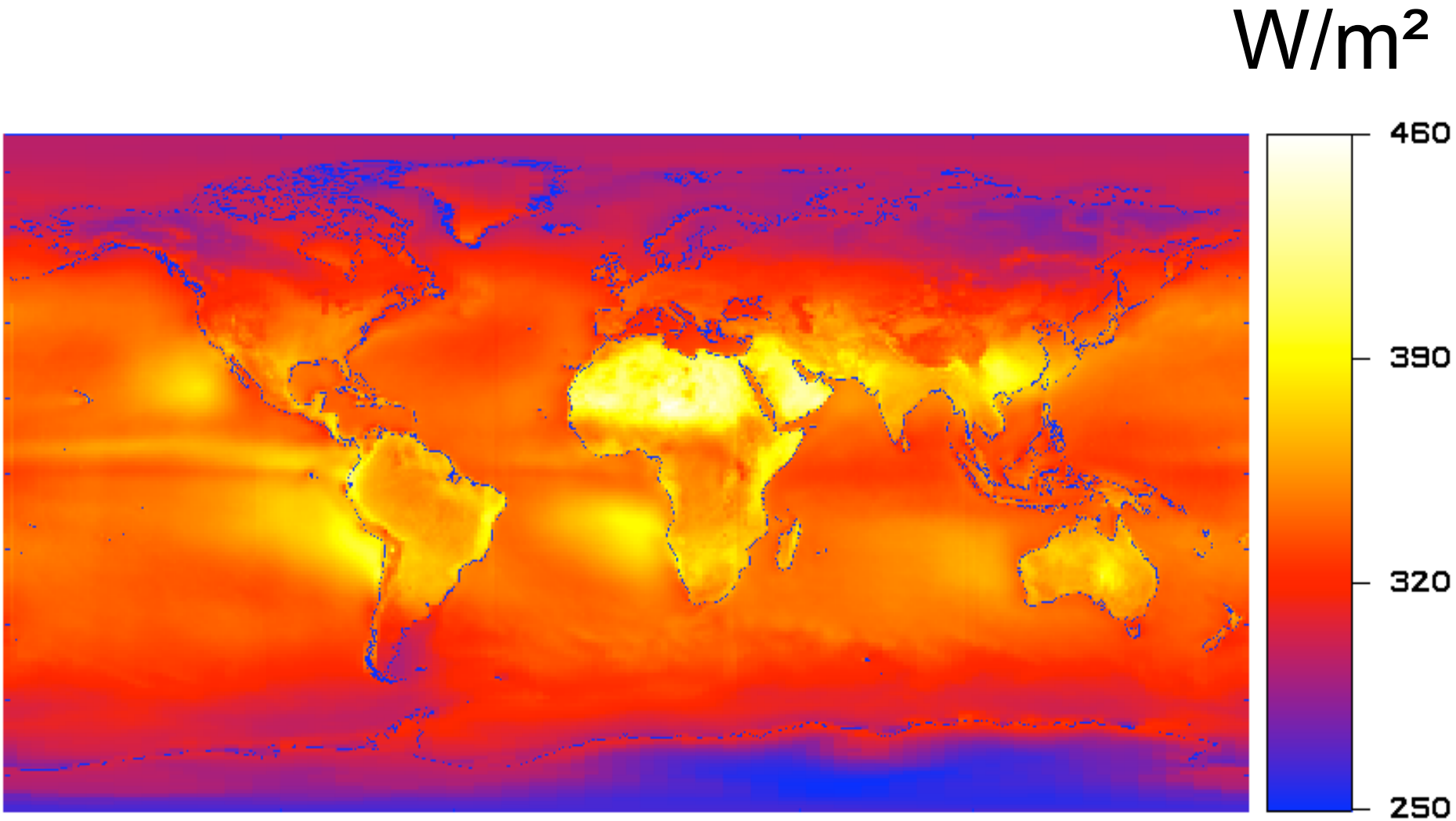


Annual Mean Meridional Energy Transport



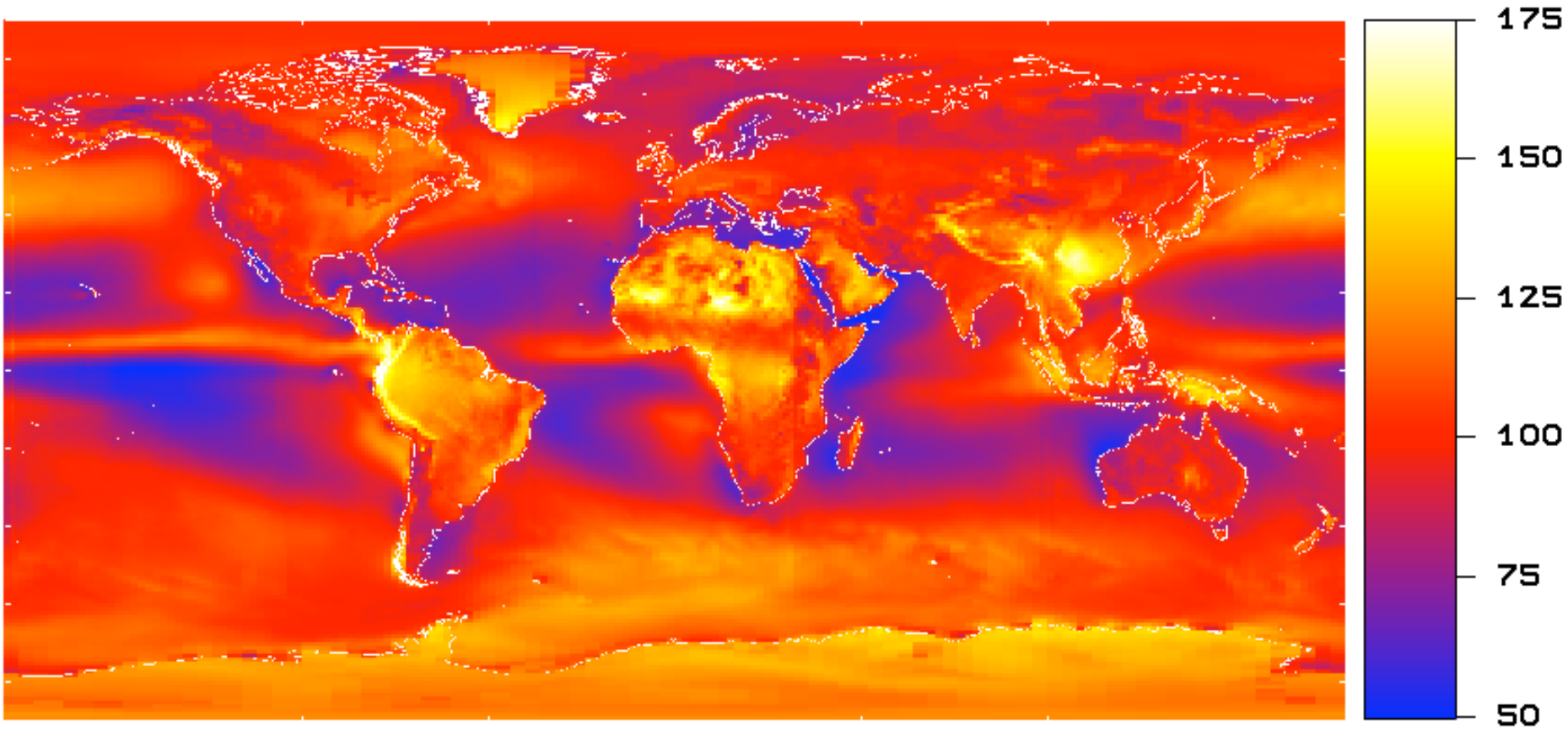
Fasullo and Trenberth 2008

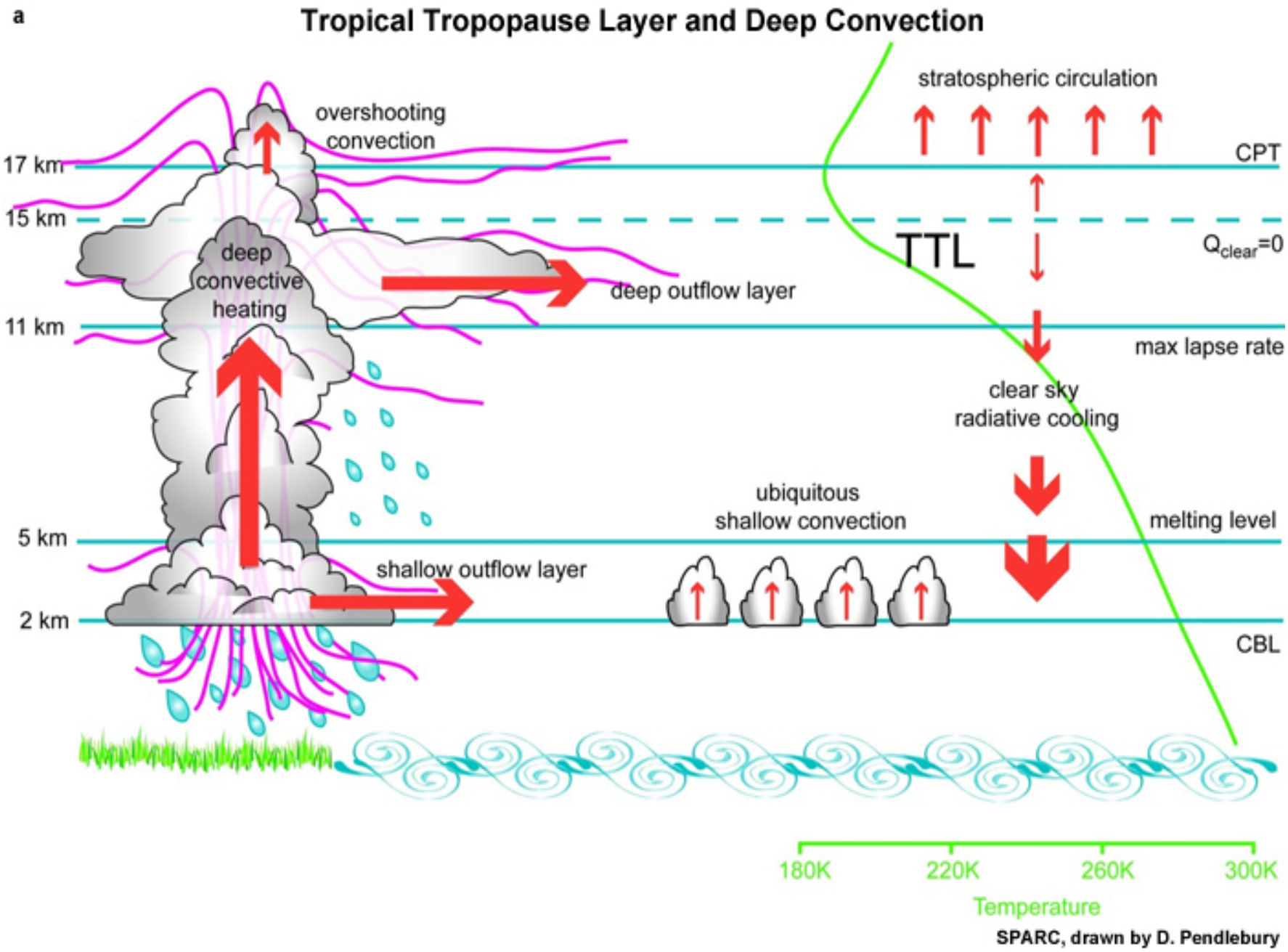
Total outgoing



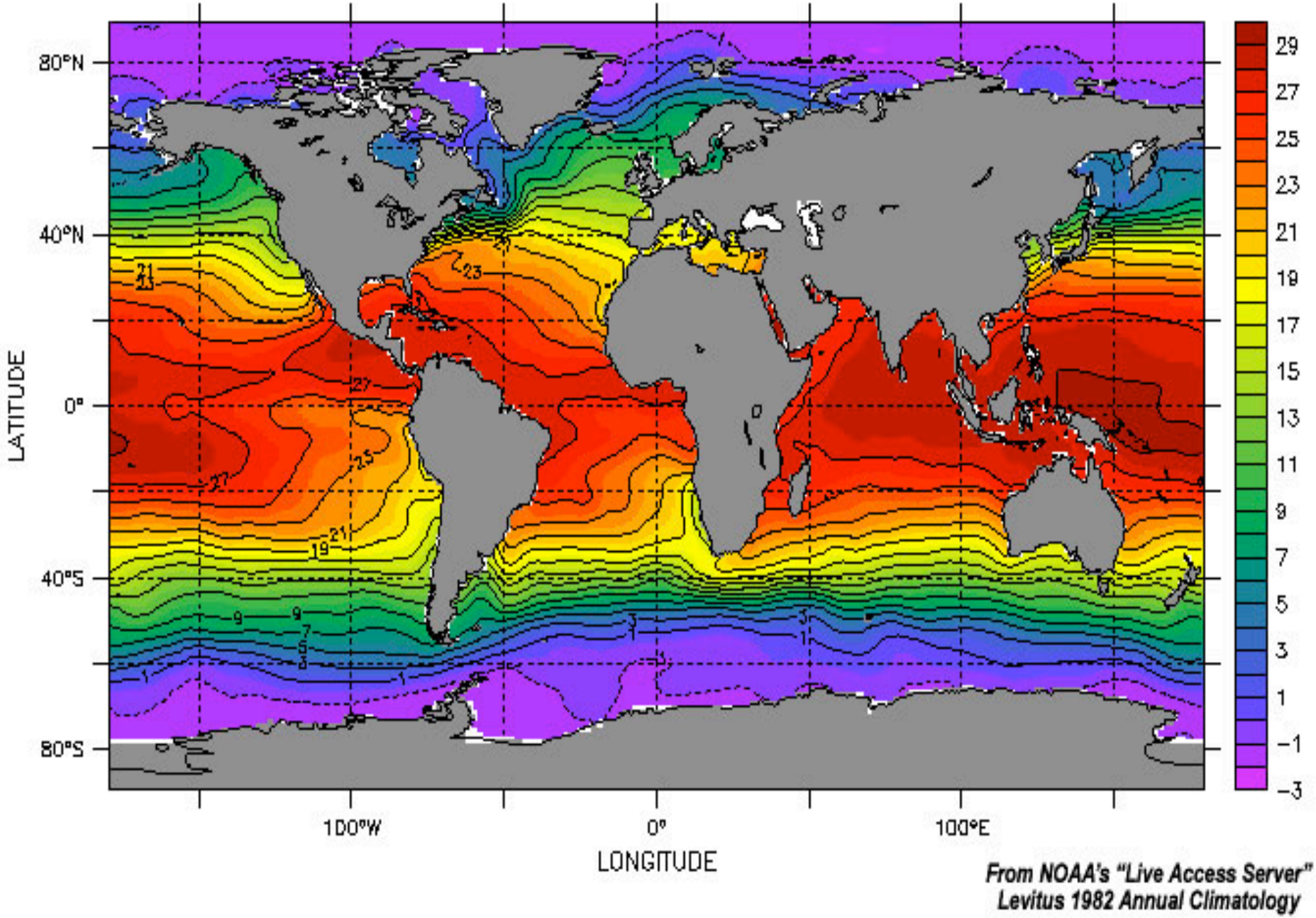
Reflected solar

W/m²



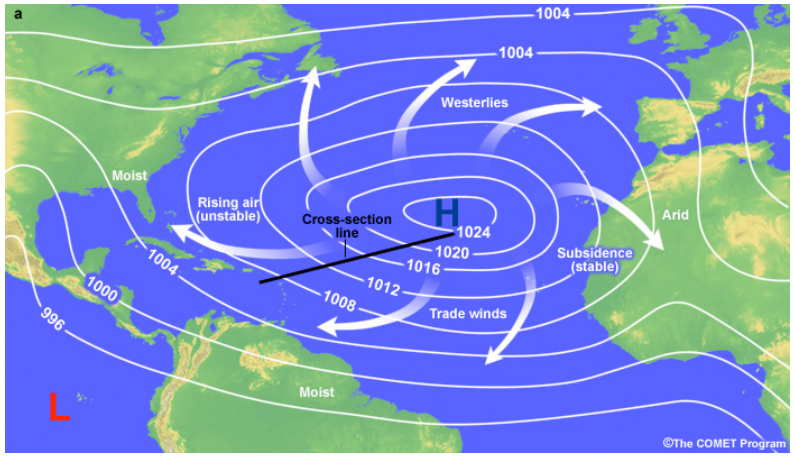

a
Tropical Tropopause Layer and Deep Convection
stratospheric circulation
overshooting convection
17 km
CPT
15 km
TTL
Q_{clear}=0
deep convective heating
deep outflow layer
11 km
max lapse rate
clear sky radiative cooling
ubiquitous shallow convection
melting level
5 km
shallow outflow layer
2 km
CBL
180K
220K
260K
300K
Temperature
SPARC, drawn by D. Pendlebury

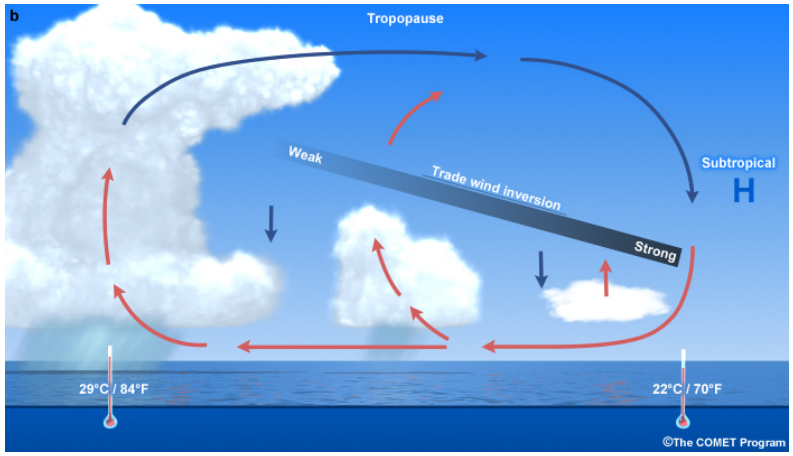
Average Sea Surface Temperature (°C)

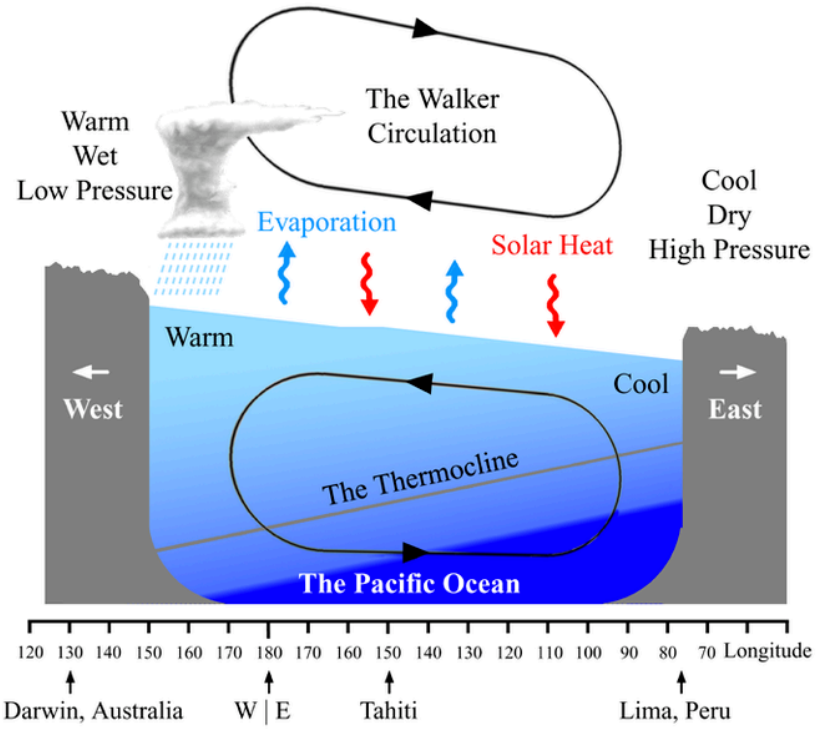


From NOAA's "Live Access Server"
Levitus 1982 Annual Climatology

High pressure <-> Low SST <-> Stratocumulus

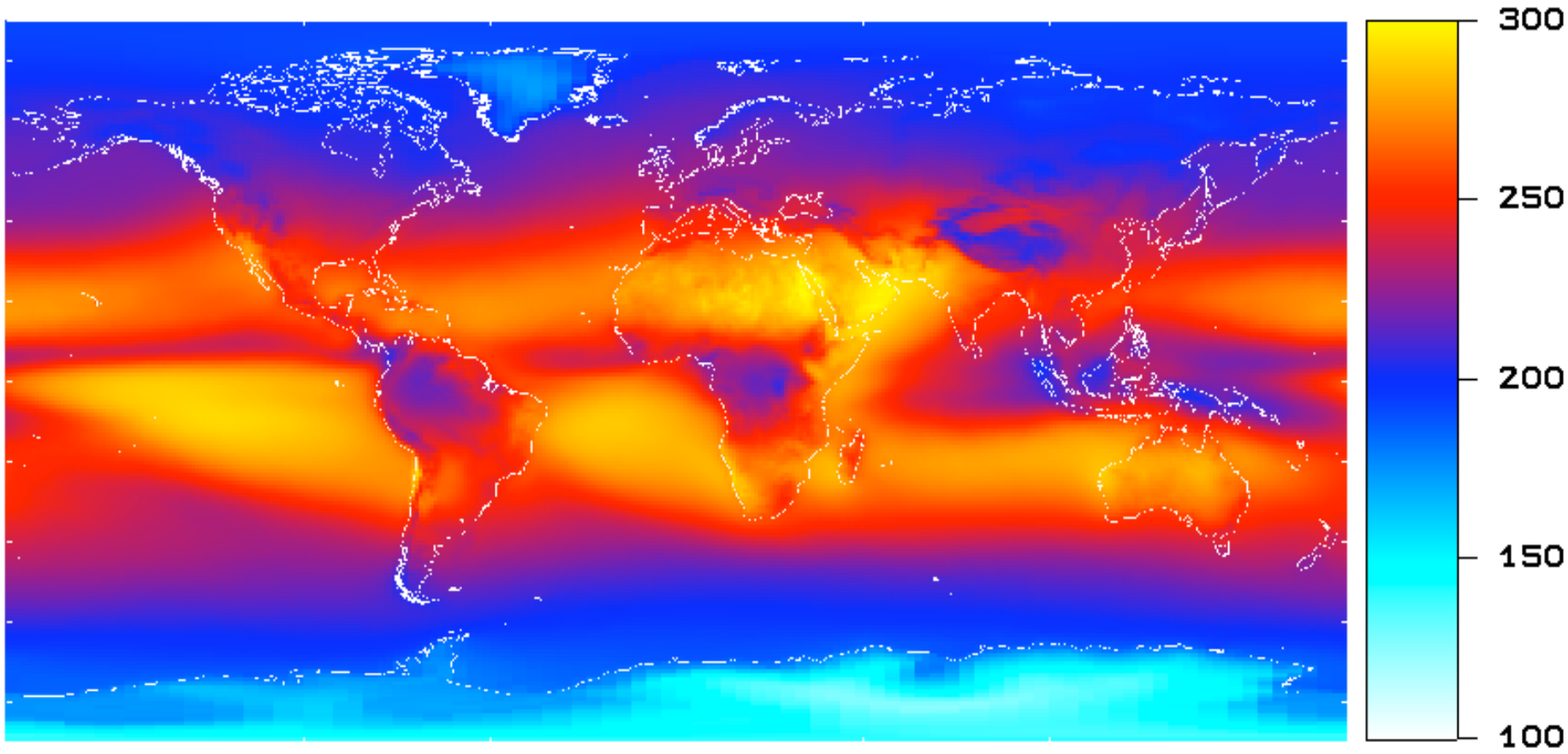




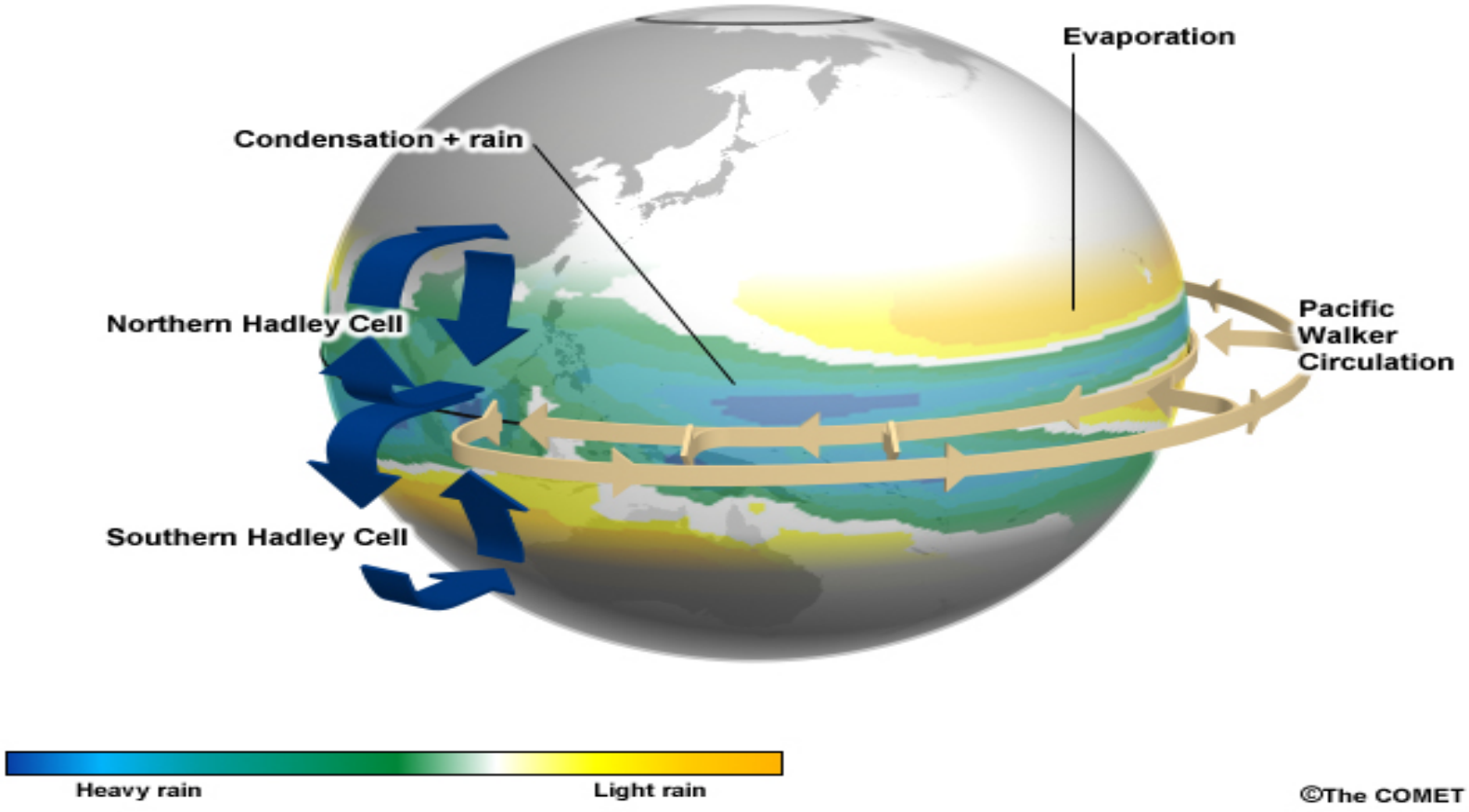


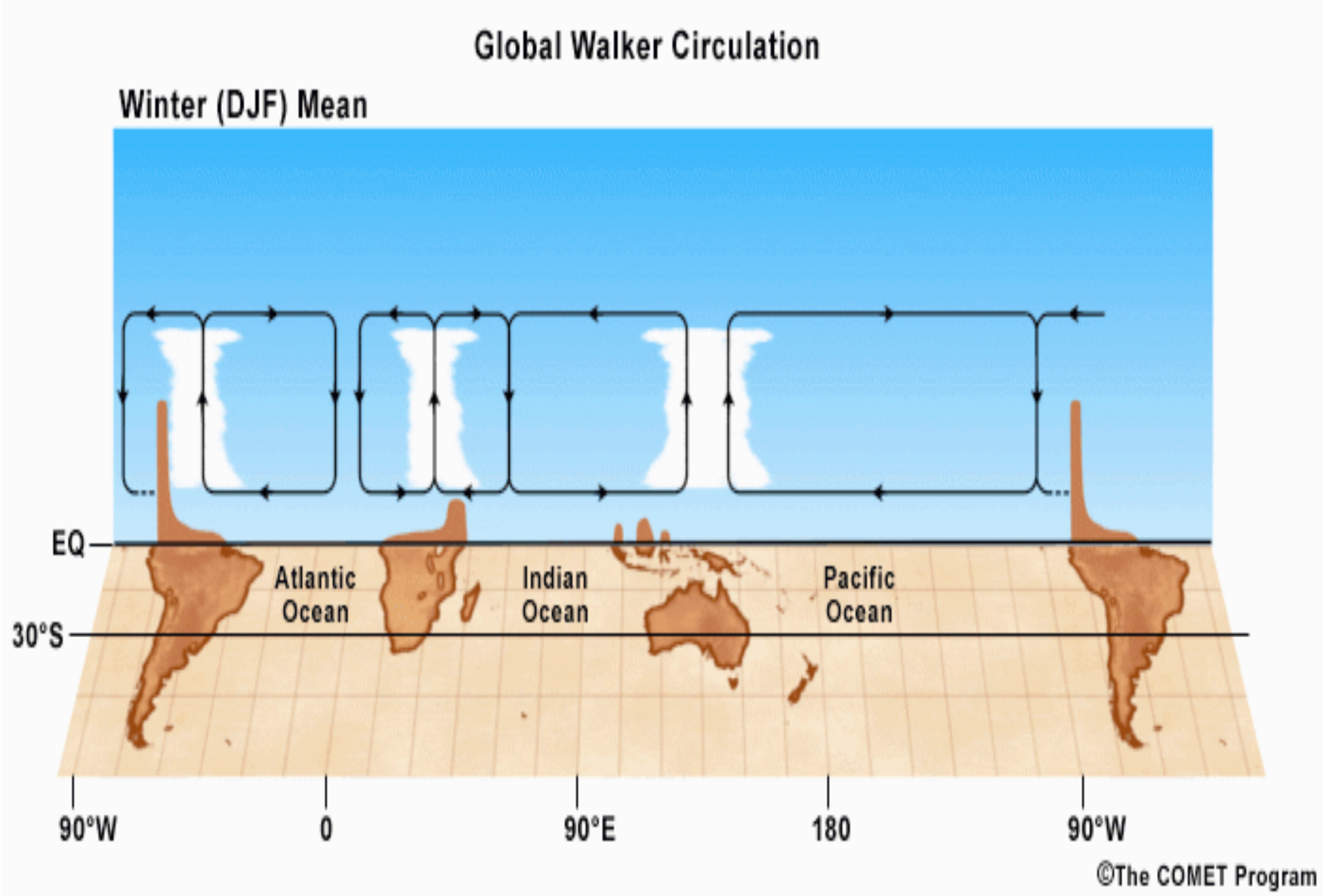
Emitted thermal

W/m²

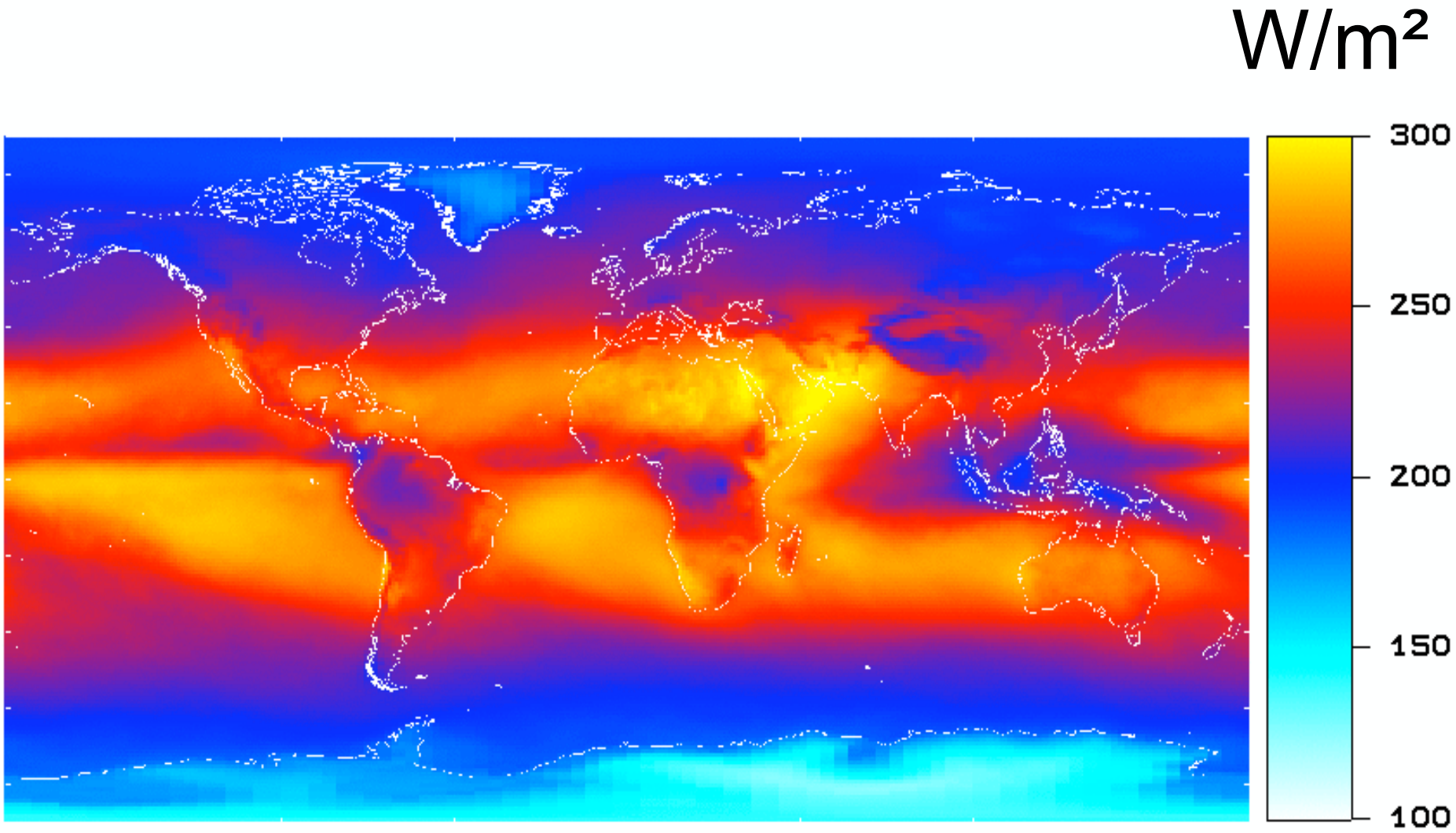


Hadley and Walker circulation

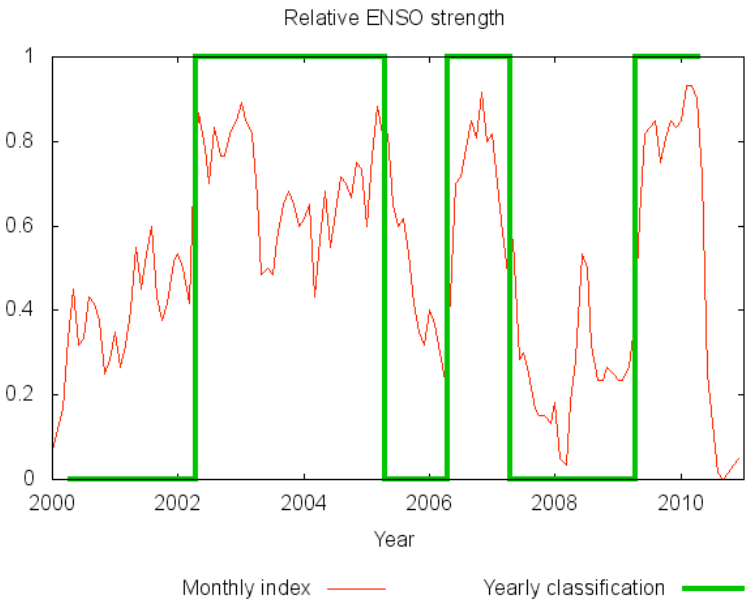



Global Walker Circulation
Winter (DJF) Mean
EQ
30°S
Atlantic Ocean
Indian Ocean
Pacific Ocean
90°W
0
90°E
180
90°W
©The COMET Program

Interannual variation



El Nino / La Nina characterisation



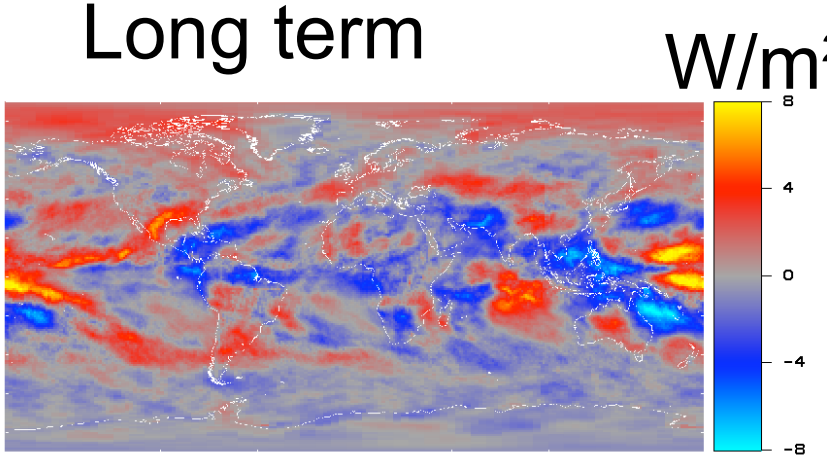
Multivariate El nino index [Wolters,2011]

La Nina – El Nino change = average over 5 strongest La Nina years - average over 5 strongest El Nino years

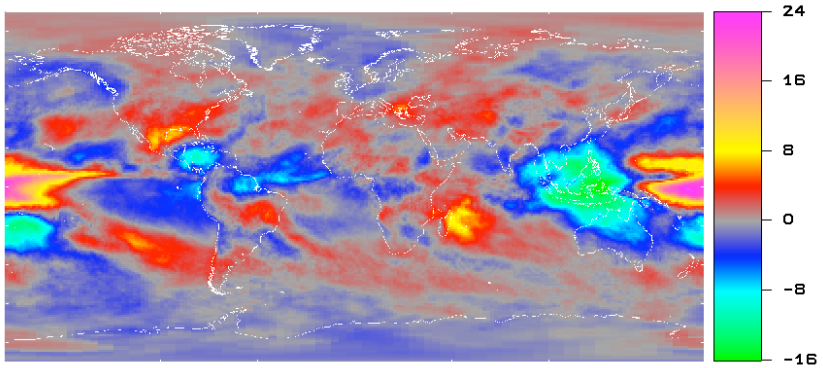
Long term change = average over last 5 years - average over first 5 years

Long term change compared to La Nina – El Nino

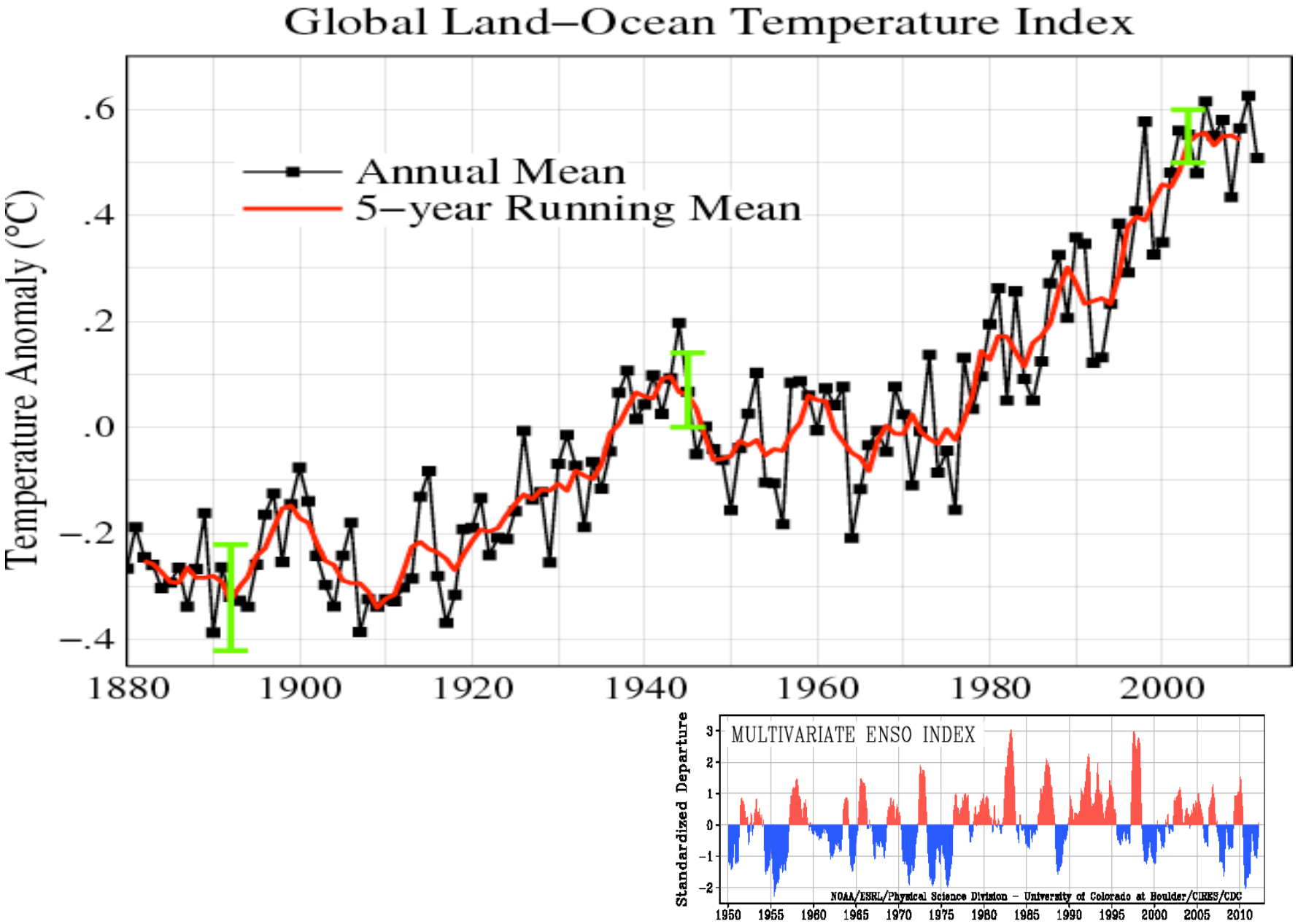
Long term



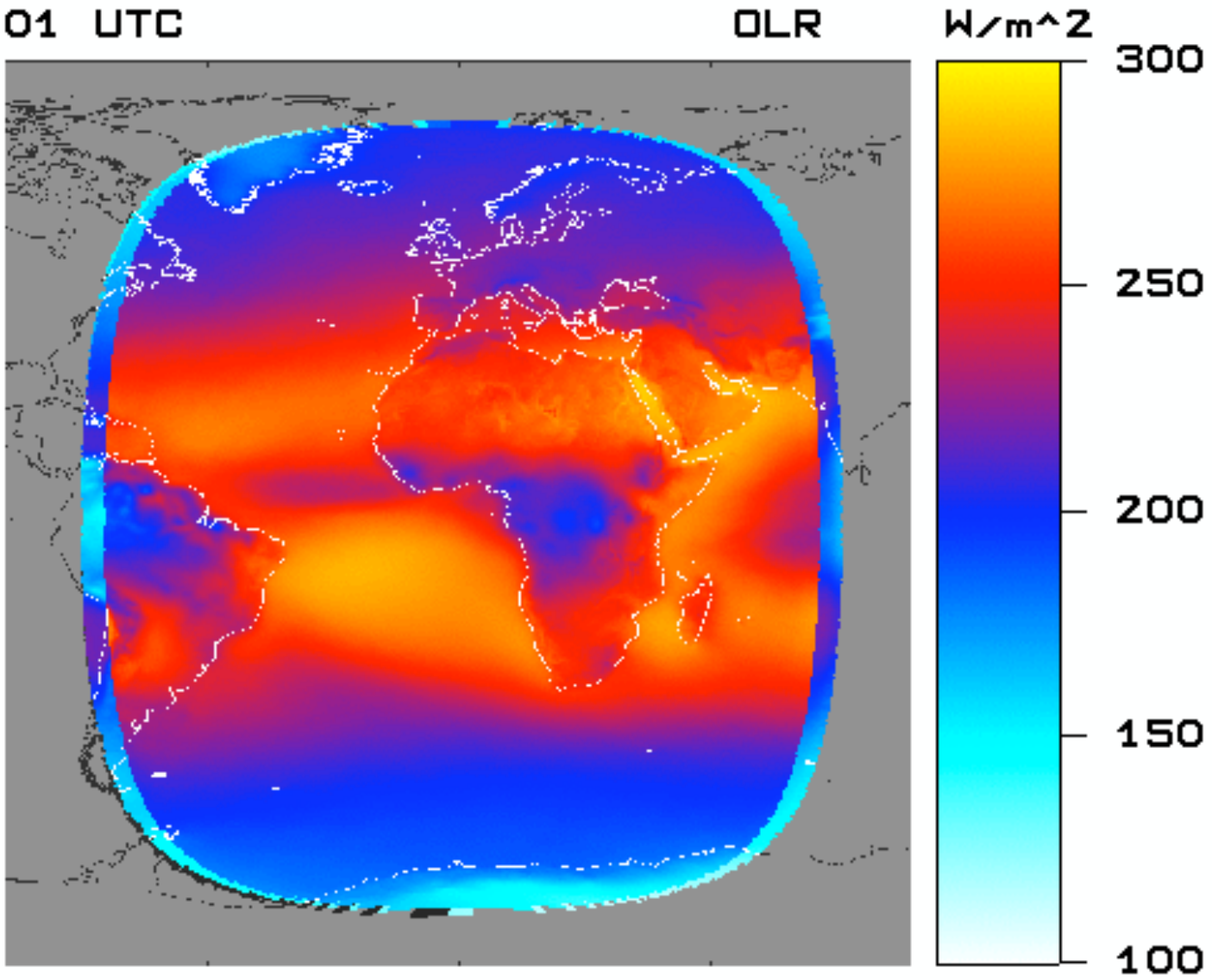
La Nina – El Nino

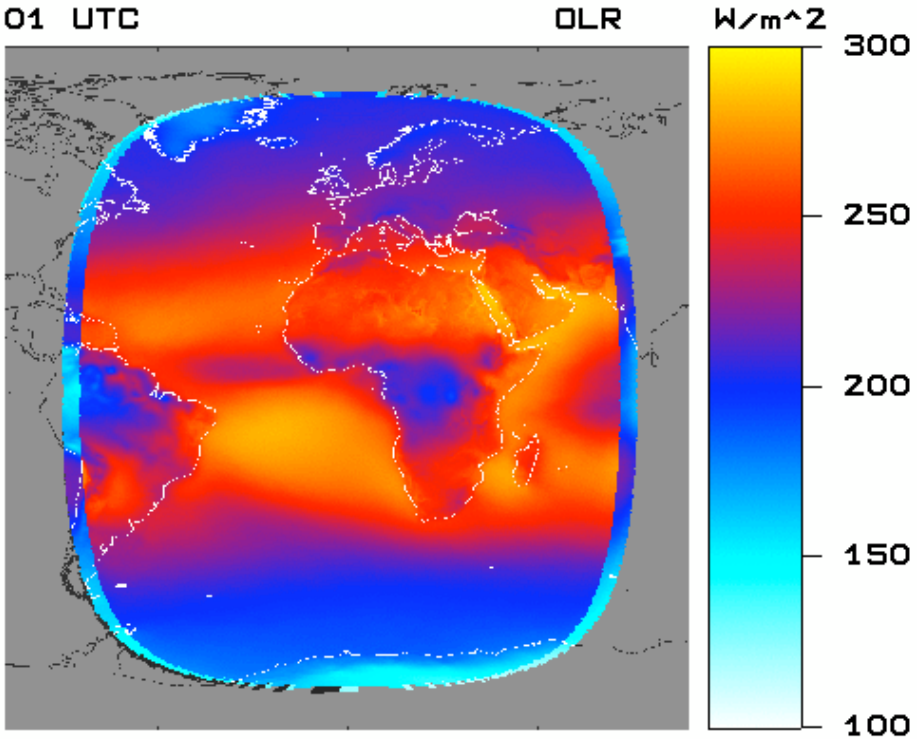


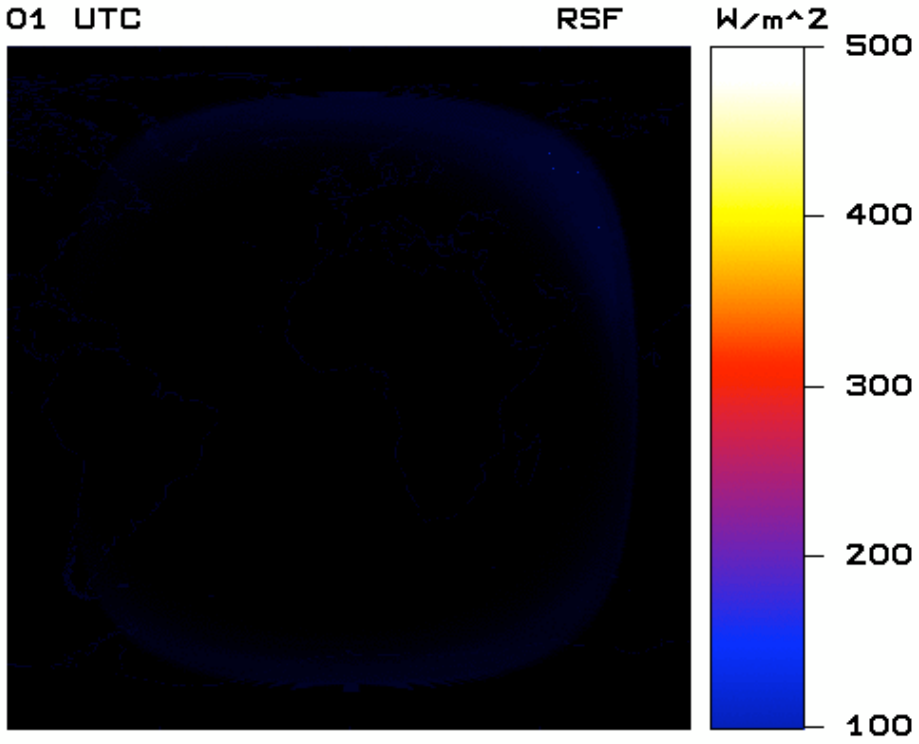
- Main change: strengthening of La Nina
  - Consistent with 'break' in global warming.
- Faint warming in the Arctic, related to ice melting ?


Global Land–Ocean Temperature Index
Temperature Anomaly (°C)
.6
.4
.2
.0
–.2
–.4
Annual Mean
5–year Running Mean
1880
1900
1920
1940
1960
1980
2000
MULTIVARIATE ENSO INDEX
Standardized Departure
3
2
1
0
–1
–2
NOAA/ESRL/Physical Science Division – University of Colorado at Boulder/CIRES/CDC
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010

7 year GERB mean diurnal cycle




01 UTC
OLR
W/m^2
300
250
200
150
100


01 UTC
RSF
W/m^2
500
400
300
200
100

To be investigated

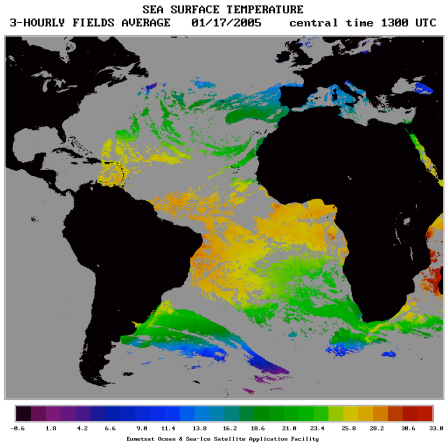
Diurnal cycle important for understanding/ parametrisation of tropical convection = thé key element of climate variability

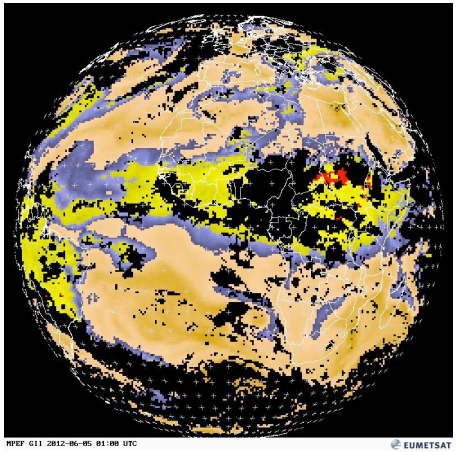
Also important for NWP !

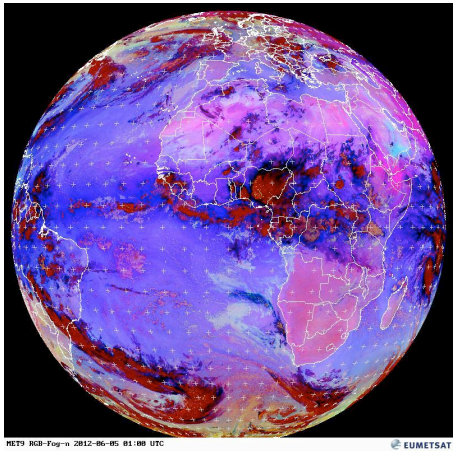
Southern Atlantic = known problem area in coupled climate models

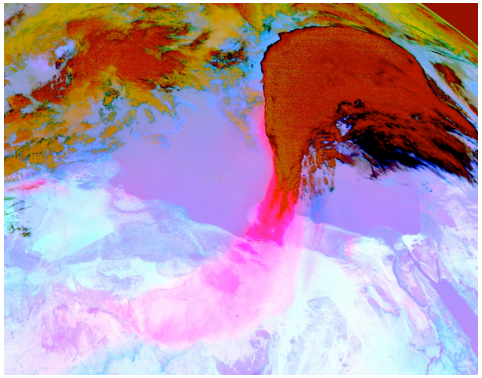
Africa = major source of aerosols (desert dust + biomass burning): will influence stratocumulus life time

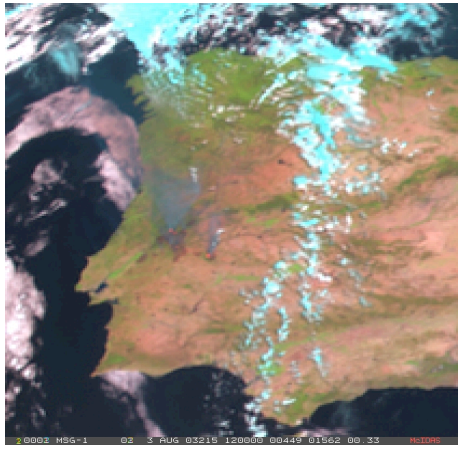
SEVIRI information content

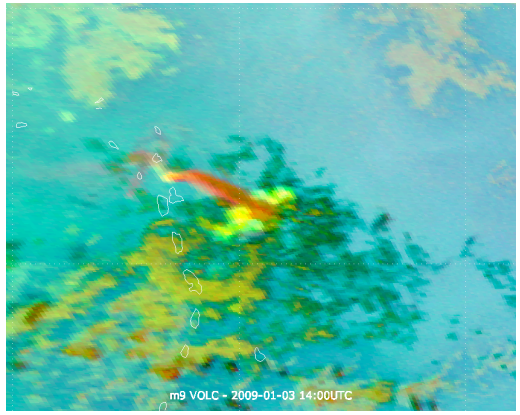








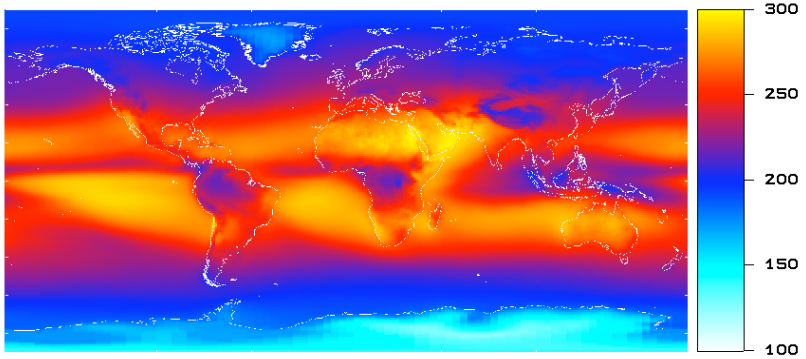




Opportunity for the future

- MSG 3 launched 5 July 2012

➢Opportunity to move MSG 1 with Gerb and Seviri over Indian ocean



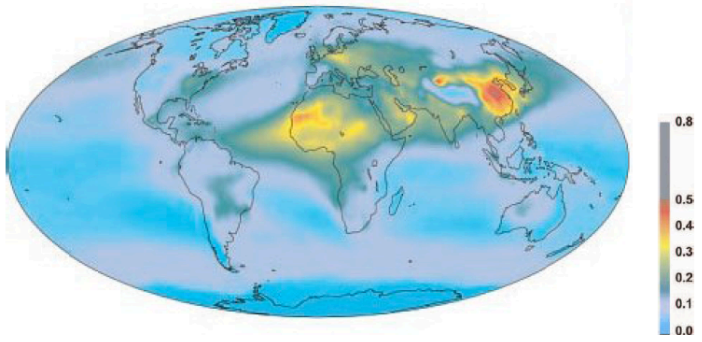


Figure 1.1: adopted from Ramanathan et al. (2001). Global distribution of natural and anthropogenic annual mean Aerosol Optical Depth (AOD).

Conclusions

Tropical convection is thé key element in climate variability.

The climate variability and change from 2000 onwards is dominated by La Nina strengthening, linked to 'Eastern dimming' ?

Gerb provides unique possibility to study the diurnal cycle, particularly in the climate model problem zone of the Southern Atlantic.

MSG 1 move to Indian Ocean will extend Gerb/ Seviri coverage of tropical convection and aerosol.